Scrap Tire Characteristics

1. Tire Derived Fuel Analysis

Representative Analysis of TDF Produced By WRI

(Source: TDF Produced From Scrap Tires with 96+% Wire Removed)

Description	%By Wt, As Received	%By Wt, Dry Basis
Proximate Analysis		
Moisture	0.62	---
Ash	4.78	4.81
Volatile Matter	66.64	67.06
Fixed Carbon	27.96	28.13
Total	100.00	100.00

Ultimate Analysis		
Moisture	**0.62**	**---**
Ash	**4.78**	**4.81**
Carbon	**83.87**	**84.39**
Hydrogen	**7.09**	**7.13**
Nitrogen	**0.24**	**0.24**
Sulfur	**1.23**	**1.24**
Oxygen (by difference)	**2.17**	**2.19**
Total	**100.00**	**100.00**
Elemental Mineral		
Analysis (Oxide Form)		
Zinc	**1.52**	**1.53**
Calcium	**0.378**	**0.380**
Iron	**0.321**	**0.323**
Chlorine	**0.149**	**0.150**
Chromium	**0.0097**	**0.0098**
Fluoride	**0.0010**	**0.0010**
Cadmium	**0.0006**	**0.0006**
Lead	**0.0065**	**0.0065**
Others below detectable limits		
Heat Value	**BTU/lb**	**kJ/kg**
HHV	**16,250**	**37,798**
HV Ave	**15,500**	**36,053**
TDF Combustion		
Characteristics	**° F**	**° C**
Tires ignite (flash point)	**550 - 650**	**288 - 343**
Carbon begins to burn	**842**	**450**
Carbon completely burnt	**1202**	**650**

84% OF A TIRE,S WEIGHT IS FROM RUBBER COMPOUNDS. REMAINDER IS BEAD AND BELT WIRE PLUS CARCASS AND CHAFER FABRIC

2. Typical Materials Composition of a Tire

This table lists the typical types of materials used to manufacture tires.

Typical Composition of a Tire
Synthetic Rubber
Natural Rubber
Sulfur and sulfur compounds
Silica
Phenolic resin
Oil: aromatic, naphthenic, paraffinic
Fabric: Polyester, Nylon, Etc.
Petroleum waxes
Pigments: zinc oxide, titanium dioxide, etc.
Carbon black
Fatty acids
Inert materials
Steel Wire

3. Typical Composition by Weight

This lists the major classes of materials used to manufacture tires by the percentage of the total weight of the finished tire that each material class represents.

Passenger Tire

Natural rubber	14 %
Synthetic rubber	27%
Carbon black	28%
Steel	14 - 15%

Fabric, fillers, accelerators, antiozonants, etc.	16 - 17%
Average weight:	New 25 lbs, Scrap 20 lbs.

Truck Tire

Natural rubber	27 %
Synthetic rubber	14%
Carbon black	28%
Steel	14 - 15%
Fabric, fillers, accelerators, antiozonants, etc.	16 - 17%
Average weight:	New 120 lbs., Scrap 100 lbs.

4. Densities of Shredded and Whole Tires

APPROXIMATE DENSITIES		
LOOSELY PACKED		**DENSELY PACKED**
550-600 lbs/yd^3	single pass	1220-1,300 lbs/yd^3
850-950 lbs/yd^3	2" shred	1,350-1,450 lbs/yd^3
1,000-1,100 lbs/yd^3	1 1/2" shred	1,500-1,600 lbs/yd^3
100/10Yd^3	WHOLE TIRES (PASSENGER/LIGHT TRUCK)	500/10Yd^3
	10 MESH- 29 lbs/ft^3 20 MESH- 28 lbs/ft^3 30 MESH- 28 lbs/ft^3	

40 MESH- 27 lbs/ft^3
80 MESH- 25-26 lbs/ft^3

5. Rubber weight by tire component.

A tire is manufactured from several separate components, such as tread, innerliner, beads, belts, etc. This table shows which components account for the rubber used to make the tire.

RUBBER PERCENT BY WEIGHT IN A NEW RADIAL PASSENGER TIRE

TREAD	32.6%
BASE	1.7%
SIDEWALL	21.9%
BEAD APEX	5.0%
BEAD INSULATION	1.2%
FABRIC INSULATION	11.8%
INSULATION OF STEEL CORD	9.5%
INNERLINER	12.4%
UNDERCUSHION	3.9%
	100.0%

6. Tire Derived Fuel By-Products Analysis

The data presented in the following two tables is analysis of bottom ash and fly ash from a facility combusting only Tire Derived Fuel. It would not be representative of facilities that use TDF as a supplement to another fuel, such as coal or wood.

PRELIMINARY RESULTS OF SLAG (BOTTOM ASH) ANALYSIS

COMPOUND	SAMPLE 1	SAMPLE 2	AVERAGE
Total Carbon -- %	0.071	0.258	0.164
Aluminum	0.128	0.283	0.206
Arsenic	0.002	---	0.001
Cadmium	0.001	0.001	0.001
Chromium	0.978	0.068	0.523

Copper	0.255	0.320	0.288
Iron	95.713	96.721	96.217
Lead	0.001	0.001	0.001
Magnesium	0.058	0.059	0.058
Manganese	0.058	0.307	0.416
Nickel	0.241	0.093	0.167
Potassium	0.010	0.015	0.012
Silicon	0.340	0.246	0.293
Sodium	0.851	0.701	0.776
Zinc	0.052	0.160	0.106
Tin	0.007	0.006	0.006
Sulfur	0.766	0.762	0.764
	100.0	100.0	100.0

ANALYSIS OF SCRAP TIRE FLY ASH

Contents	Weight by Percentage	
Zinc		51.48%
Lead		0.22%
Iron		6.33%
Chromium		0.03%
Copper		0.55%
Nickel		0.03%
Arsenic		0.02%
Aluminum		0.76%
Magnesium		0.50%
Sodium		0.01%
Potassium		0.01%
Magesium Dioxide		0.36%
Tin		0.03%
Silicon		6.85%
Cadmium		0.05%
Carbon		32.20%
	Total	99.43%
Note: These results are from incineration of 100% tire fuel.		

Sources: Radian Corporation, Results From Sampling and Analysis of Wastes From the Gummi Mayer Tire
Incinerator, May 1985.

7. Steel Tire Cord Analysis

ASTM 1070 Steel Tire Wire

There are approximately 2.5 pounds of steel belts and bead wire in a passenger car tire. This material is made from high carbon steel with a nominal tensile strength of 2,750 MN/m2 and the following typical composition:

	STEEL BELTS	BEAD WIRE
Carbon	0.67 - 0.73%	0.60% min.
Maganese	0.40 - 0.70%	0.40 - 0.70%
Silicon	0.15 - 0.03%	0.15 - 0.30%
Phosphorus	0.03% max.	0.04% max.
Sulfur	0.03% max.	0.04% max.
Copper	Trace	Trace
Chromium	Trace	Trace
Nickel	Trace	Trace
COATING	66% Copper 34% Zinc	98% Brass 2% Tin